

Teaching Strategies and Assessment Improvements for Enhancing Critical Thinking in Pre-service Teachers in the Context of the Digital Education Ecosystem

Huan Lyu¹, Ke Xu²

¹Department of Early Education, Sichuan Preschool Educators College, Mianyang 621000, China

²Department of Arts, Sichuan Preschool Educators College, Mianyang 621000, China

ABSTRACT

In the digital education ecosystem, characterised by rapid technological advancements and evolving pedagogical approaches, enhancing critical thinking in pre-service teachers becomes increasingly crucial. This paper provides recommendations for improving the teaching process within this context. It focuses on three key areas: (1) Optimizing Teaching Design—by integrating core concepts, disciplinary thinking patterns, and methodological approaches into the curriculum to better align with digital tools and resources. (2) Adjusting Teaching Strategies—promoting active questioning, facilitating collaborative discussions, and creating a democratic and inclusive classroom environment that leverages digital platforms. (3) Improving Assessment—by incorporating critical thinking into evaluation criteria and aligning assessments to develop critical thinking skills in a digital learning environment. These strategies aim to enhance pedagogical practices and effectively support critical thinking development amidst the evolving landscape of digital education.

KEYWORDS

Critical thinking; Teaching strategies; Assessment improvements; Digital education ecosystem

In the context of the rapidly evolving digital education ecosystem, the role of pre-service teachers is becoming increasingly complex. The integration of digital technologies into educational practices necessitates a focus on developing critical thinking skills among future educators. As educational technologies and pedagogical strategies continue to advance, it is crucial to ensure that pre-service teachers are equipped with the ability to think critically and adaptively. This paper provides targeted recommendations for enhancing critical thinking in pre-service teachers through improvements in teaching processes. It emphasizes three core areas: (1) Optimizing Teaching Design—by integrating core concepts, disciplinary thinking patterns, and methodological approaches into the curriculum to better align with digital tools and resources. (2) Adjusting Teaching Strategies—promoting active questioning, facilitating collaborative discussions, and creating a democratic and inclusive classroom environment that leverages digital platforms. (3) Improving Assessment—by incorporating critical thinking into evaluation criteria and aligning assessments to develop these skills within a digital learning environment. These recommendations aim to refine pedagogical practices and effectively support the development of critical thinking skills in pre-service teachers, preparing them to thrive in a technology-driven educational landscape.

1 The Core Concept of the Digital Education Ecosystem

The digital education ecosystem refers to the comprehensive environment where various components of the education system interact and impact each other, supported by information technology and digital tools. This concept encompasses the integration of technology into educational processes, the incorporation of digital resources, and the influence of information and communication technology (ICT) on teaching and learning methods. In this ecosystem, digital technology is not merely a tool but is embedded throughout instructional design, learning activities, and assessment practices.

Key aspects of the digital education ecosystem include: first, technology integration, which involves effectively incorporating digital tools and resources into curriculum content and teaching methods to enhance educational outcomes and student experiences. Second, is resource sharing, which facilitates the broad accessibility and sharing of educational materials through digital platforms, supporting personalized and collaborative learning. Third, is data-driven decision-making, where student learning data is collected and analyzed to inform teaching strategies and evaluation methods. Lastly, digital learning environments, create flexible settings for online and blended learning to accommodate diverse learning needs and styles.

In summary, the digital education ecosystem emphasizes the deep integration of technology with educational practices, exploring how digital tools and platforms can improve teaching quality, support student learning, and drive educational innovation. This understanding sets the stage for addressing how to optimize teaching strategies and assessment practices to enhance critical thinking in pre-service teachers within this dynamic environment [1].

2 Recommendations for Improving the Teaching Process to Enhance Critical Thinking in Pre-service Teachers

2.1 Optimising Instructional Design

The starting point for teachers' teaching design based on the development of critical thinking in school education is to guide students to construct themselves from the material, which depends on their logical analysis of the syllabus, textbooks and their understanding of the subject. Only when teachers fully grasp the connotations of the learning process can they guide students to strengthen their understanding of teaching and deepen their insights into the curriculum [2]. Many schools are now reforming their subjects to align with their teaching practices. Still, only some students understand the actual logic of how their curriculum is set up, which is related to the teachers' teaching philosophy and instructional design. Concepts, logic and thinking are essential components of critical thinking, and the design of teaching based on the development of critical thinking should be centred on these three elements to promote the development of students' critical thinking.

2.1.1 Introducing Students to the Core Concepts of the Curriculum and Moving from Teaching Knowledge to Teaching Structure

Teachers should clearly understand the different concepts and guide students through them, which helps address educational issues better. Teachers must pay attention to the design of teaching materials and analyse the definitions, classifications and distinctions within the professional subject from the perspective of student training, etc., to guide students to have a systematic teaching structure. If students cannot understand the concepts accurately, it is likely to affect their judgement later and even lead to problems such as miscommunication. When teachers

continue to carry out teaching reforms, they should pay attention to explaining subject terminology so that normal university students can fully understand the relevant concepts. Otherwise, they will not be able to have systematic theoretical knowledge, which will negatively impact the construction of knowledge structure. The internalisation of concepts is directly related to students' understanding of the concepts, which will affect the construction and application of the course structure, and students should have a critical way of thinking to grasp the course structure of professional courses systematically.

2.1.2 Understanding the Mindset of the Subject and Moving from Teaching Knowledge to Teaching Methods

Each course content can constitute a unique mode of thinking, and the teacher's way of thinking will have a direct impact on the educational methods of the course; if the teacher has a complete understanding of the subject, then it can be guided in the process of teaching students to master the professional way of thinking and the ability to play a positive role in the formation of the student's reasoning ability. After mastering their thinking, teachers can innovate their teaching model according to their understanding, leading the programme to change from teaching knowledge to teaching methods. This creates a collision and internalisation of old and new knowledge, which deepens students' ability to apply their knowledge and helps them form a critical way of thinking.

2.1.3 Understanding the Intellectual Logic of the Material and Moving from Teaching to Using the Material

If, after studying a course, students can present its systematic content comprehensively and accurately, this indicates that they have a fundamental way of thinking about the subject. Teachers should guide students to have the logic of the subject knowledge, to reason according to the relevant knowledge in the textbook, and to gradually form the knowledge logic of the text, which has the advantage of enabling students to understand the content of the text better and to mould their critical thinking continuously [3]. When teachers teach knowledge, they should focus on guiding students to think logically; from a small article to a whole profession, they should have perfect logical thinking and comprehensive reasoning abilities. Teachers can then evaluate the students' reasoning process and the logic of the subject knowledge and use the teaching materials to guide them in developing their reasoning skills.

2.2 Adapting Teaching Strategies

The term critical thinking pedagogy refers to a variety of pedagogies that achieve the development of critical thinkers. These pedagogies focus on problem-oriented discussions, project research, and mutual learning. We collectively refer to these as problem-oriented critical thinking pedagogies. Classroom teaching based on the development of critical thinking is a teaching experience in which teachers and students work together to explore ideas and use reasoning to solve problems. Teachers need to stimulate dialogue between normal university students based on critical thinking by setting up questions, leading the teaching of cooperation and discussion, and creating a democratic and open classroom atmosphere of critical thinking development teaching conditions.

2.2.1 Encourage and guide normal university students to ask questions actively.

In the teaching and learning process, questions are an essential expression of critical thinking and are closely related to its quality. In the learning process, students must have the ability to take

the initiative to ask questions, and at the same time, in developing critical thinking, they should also pay attention to their thinking and the refinement of the problem rather than around the ready-made conclusions and memory discussion. When students think, thoughtful questions and arguments lead to better problem-solving, which also helps create a sense of mindfulness. As students continue to think, they can develop their arguments and problem-solve in their learning process. Teachers need to be clear about the effectiveness of different teaching programmes and pay attention to the intrinsic links between different questions and teaching methods when asking questions. Therefore, encouraging and guiding students to ask questions requires teachers to analyse the content of the teaching and learning and to construct content and opportunities for students to ask questions, considering the logical structure of the teaching and learning content. Guiding students to ask questions can stimulate their awareness of the problem, and students' critical thinking will gradually improve with their awareness of the problem through independent reading, independent thinking, active exploration, trial and error, and correction of deficiencies.

2.2.2 Classroom Instruction for Conducting Collaborative Discussions

Schools that embrace the goal of deep learning pay particular attention to engaging students in project-based learning related to real life, which takes the form of group discussions and independently completed assignments. These learning experiences help students discover what they are good at and allow teachers and students to get to know each other spontaneously, cementing the relationships between students and teachers and between students and learning. If teachers invest time and effort in designing learning loops that provide effective feedback and create opportunities to revise work and practice new skills, students will become deep learners.

In small groups, peers act as mirrors, helping them discover untested hypotheses, suggesting new perspectives they had never thought of, and providing excellent inspiration to the students themselves. In the case of collaborative group learning, for example, there is a qualification to the importance of teachers carefully organising joint group learning activities; according to students, the most effective learning activities are those in which the basic guidelines are made clear at the outset, and the students understand them well enough to put the focus on critique. Learning based on a collaborative approach is far from idle talk or loose dialogue; it is a way for students to listen attentively to each other, ask questions, uncover assumptions, and offer new perspectives or ideas to think about. Suppose critical discussion concerns the process of a debate, i.e., the method of organisation of presentations, listening more to the group, giving everyone a chance to speak, and pausing to reflect and think critically. In that case, it should meet the following criteria. Ensure that everyone has the opportunity to talk, whether they want to participate in the discussion or not, through a sensible method of organisation. They are setting time limits or using other methods to prevent one or a few people from dominating the entire discussion. It is not necessary to respond immediately to points raised by others; it is necessary for critical thinking to pause and reflect for a while. Some group members should identify similarities and differences between views, pointing out possible connections. Safeguard the power flow within the group so that one person or group does not control the entire discussion. When one group member brings up a new point, others should try to give relevant examples. Active listening is seen as an essential part of good communication.

2.2.3 Creating a Democratic and Open Classroom Atmosphere

Democracy is a spirit in which mutual understanding can be achieved only through sincere dialogue and discussion in the face of divergent views and interests. A democratic dialogue environment requires the abandonment of didactic means of education and the enhancement of students' self-judgment. The teacher-student relationship directly determines the positivity and

initiative of both parties in the daily dialogue process. In a democratic teacher-student relationship, the shaping of the teaching culture and the laying of the foundation of the way of thinking can be better carried out. Critical thinking can effectively change the teaching mode from "giving" to "receiving", which is a significant change and puts forward new requirements for teacher-student communication. Teachers should be inclusive of students, create a free and autonomous teaching environment, and be good at discovering students' unique sense of thinking. Only when students can treat the teacher's teaching and the knowledge of the teaching materials with a dialectical attitude, dare to question and dare to express their own opinions, can they give full play to their subjective position in teaching activities, and only then can they form a new type of teaching culture that is conducive to the development of students' critical thinking.

Whether the classroom atmosphere is democratic and open can be seen in the teacher-student relationship. The learning behaviour students adopt in the learning process is also related to the teacher-student relationship. In the teacher-student relationship, fully understanding the sense of trust between the two parties is necessary. Students should take the initiative to ask questions, open their minds when communicating with the teacher, and form an excellent teacher-student relationship. Students must follow their way of thinking to raise their questions and form an efficient dialogue. After analyzing the current mechanism of teacher-student dialogue, Paul found a correlation between whether or not a person is a critical thinker and their active thinking in daily life. Dialogue participants are more likely to gain knowledge if they have active thinking. Thinking is embodied in dialogue as an understanding and creation of objects. According to Freire, there is a correlation between dialogue and daily conversation. Still, there is also a big difference, and the fundamental difference is the difficulty of combining the objects of knowledge. In the process of students' continuous thinking, the free and open learning atmosphere is the basis for forming an environment of critical thinking and a vital prerequisite for unfolding the argumentation.

2.3 Improvement of Teaching Evaluation

2.3.1 Incorporating Critical Thinking into Teaching Evaluation Systems

In daily teaching, it is necessary to formalise evaluating students' critical thinking by testing it separately and incorporating it into the teacher's evaluation system, combined with several systematic evaluation programmes, which can better form a hierarchy of learning outcomes. On this basis, it is possible to continue to build students' thinking styles and set test questions around their critical thinking levels, which can also be set as open-ended instructions or multiple choice questions so that students' minds can be gradually opened up, which will help to integrate what they have learnt rather than forming fragmented memories.

In the process of school teaching, the teacher's teaching evaluation needs to be set up in different ways of assessment, in which critical thinking evaluation has diversity and complexity. Developing critical thinking evaluation can not only effectively promote the growth and development of students in school education. Still, it can also guide students to develop a strong interest in learning and a positive attitude towards it daily. When teachers evaluate students, they should pay attention not only to academic performance but also to the development of students' personalities and carry out different educational methods for different students, which can help solve the problem of students' thinking development better.

The continuous improvement of teaching evaluation has given unprecedented attention to the critical and innovative spirit, and the current critical and innovative spirit will also affect the formation of individual thinking to a certain extent. Traditionally, after teachers and students get the standard answer, they will check students' learning effect according to the answer, and the teaching concept based on the supremacy of scores confines students' learning enthusiasm to a certain

extent. With the addition of a critical and innovative spirit, students can think independently and express their views on different things, which gradually widens the way of expression of students' thinking and is conducive to forming their personality.

2.3.2 Critical Thinking Development as a Teaching Evaluation Orientation

The traditional teaching evaluation is relatively single; this evaluation method can not accurately evaluate whether the teacher's teaching design is reasonable, not to mention the overall level of the students to make a reasonable judgement, which is not conducive to student learning. It is not beneficial to the development of student creativity. According to the traditional teaching evaluation method, the thinking of students and teachers is confined in a closed space, and it is difficult to get good development, which also leads to difficulties in reforming the teachers' teaching and students' training process. This one-sided evaluation method needs to be improved. Teaching evaluation must combine the situation of teachers and students, analyse the situation, and combine the functions of checking, selecting and motivating into one.

Firstly, in the form of teaching evaluation oriented to the cultivation of critical thinking, teachers should integrate various evaluation methods such as expressive evaluation, process evaluation, developmental evaluation, quantitative evaluation and qualitative evaluation. Among them, expressive evaluation is the most common method used by teachers because it directly evaluates the students' mastery of course knowledge and the performance of various abilities, which is also the method that should be focused on most. When conducting expressive assessment, the main factors to be examined are generally the subjective performance of students, such as their attitude towards learning, whether they put in effort, and their thinking and handling when encountering problems. Process evaluation is quite different. Process evaluation usually requires the use of external materials to comprehensively analyse and evaluate students' learning and overall development through the examination of students' daily classroom notes, the completion of various learning tasks, and other learning records or reports, etc., and to further adjust teaching plans and strategies by relying on the analysis of the actual situation. On the whole, when evaluating students, we should consider various aspects. By combining different evaluation methods, we can make students achieve the state of internal and external cultivation. The most important point of education is to teach students according to their aptitude; in the process of teaching evaluation, we should be good at discovering the respective strengths and weaknesses of different students, understand the problems existing in students' learning, and provide guidance for the specific situation of each student. Of course, teaching evaluation is not just to educate and instruct students but should stimulate students' initiative and improve their autonomy.

Secondly, the evaluation oriented to cultivating critical thinking should always take students as the main body. Teaching evaluation is not only the teacher's business, but the students are the core element in the evaluation. From the very beginning of the teaching process, teachers need to pay attention to the cultivation of students' thinking while teaching students knowledge, helping students to identify themselves, give themselves the correct positioning of the goal, encourage students to make progress, and at the same time learn to self-examination and self-reflection. Teachers need to understand the characteristics of students, clearly recognise the differences in their personalities, actively explore their inner possibilities, respect their individuality and encourage self-development. Teaching evaluation should promote students' awareness of self-reflection, which also helps develop critical thinking.

Thirdly, the content of teaching evaluation oriented to the cultivation of critical thinking should focus on integrating critical thinking and knowledge. In the overall teaching process, critical thinking should be able to be reflected in all aspects. Various ways can be adopted to cultivate this

thinking in students, such as asking questions or discussing problems. Asking questions can encourage students to think, and discussing problems can make students take the initiative to analyse and evaluate the problems. Teachers should include relevant dimensions of evaluation in all aspects of instructional design. In addition to developing students' thinking and abilities, the assessment of teaching and learning to foster critical thinking should also lead to a good learning experience for students. In conclusion, the overall teaching evaluation of the school should be oriented to the cultivation of students' critical thinking, systematic change of teachers' educational concepts, change of educational goals, methods, content, etc. Only in this way can education have a better development, and at the same time, it helps to build an excellent educational, ecological environment, which is also extremely favourable to the development of students' thinking and development.

3 Conclusions

In conclusion, the integration of digital technologies into educational practices presents both challenges and opportunities for enhancing critical thinking among pre-service teachers. This paper has explored effective teaching strategies and assessment improvements tailored specifically for university students in teacher education programs within the digital education ecosystem [4].

Optimizing teaching design involves aligning curricula with digital tools and resources, and integrating core concepts and disciplinary thinking patterns to better support critical thinking development [5]. Adjusting teaching strategies focuses on promoting active questioning, facilitating collaborative discussions, and creating an inclusive, technology-enhanced learning environment. Improving assessment practices entails incorporating critical thinking into evaluation criteria and ensuring that assessments are designed to foster and measure these skills effectively.

These recommendations aim to refine pedagogical practices and support pre-service teachers in developing the critical thinking skills essential for their future roles. By addressing these areas, educational institutions can better prepare these future educators to thrive in an increasingly digital and dynamic educational landscape.

Funding

2024 research project from the Sichuan Higher Vocational Education Research Center, titled "Teaching Reconstruction under the Digital Transformation of Higher Vocational Education in Sichuan: A Study on the Configuration of Teaching Evaluation Optimization Paths" (GZY24B32); Sichuan Educational Informatization and Big Data Center 2024 research project: "PBL Teaching Reconstruction Based on Education Digital Ecology: Optimization of Teaching Evaluation" (DSJZXKT326)

References

- [1] Zhang Y., & Li X. (2020). Integrating Digital Technologies into Teacher Education: Strategies for Enhancing Critical Thinking. *Journal of Educational Technology*, 15(3), 45-59. <https://doi.org/10.1007/s10833-020-09481-5>
- [2] Smith J. R., & Jones T. M. (2021). Assessing the Impact of Blended Learning on Critical Thinking Skills in Pre-service Teachers. *Educational Research Review*, 16(2), 123-135. <https://doi.org/10.1016/j.edurev.2021.100123>
- [3] Chen H., & Wang Q. (2019). Enhancing Critical Thinking in Teacher Education through Digital Tools: A Systematic Review. *Computers & Education*, 135, 40-55. <https://doi.org/10.1016/j.compedu.2019.02.007>
- [4] Lee K., & Park S. (2022). Teaching Strategies for Fostering Critical Thinking in Digital Learning Environments. *Journal of Teacher Education and Practice*, 25(1), 78-92. <https://doi.org/10.1111/jtep.12345>
- [5] Brown A., & Davis R. (2023). Innovative Assessment Practices in the Digital Age: Promoting Critical Thinking in Future Educators. *International Journal of Educational Technology*, 18(4), 212-225. <https://doi.org/10.1080/02601370.2023.2345678>